

A TAXONOMIC REVISION OF *PODOCARPUS*
V. THE SOUTH PACIFIC SPECIES OF *PODOCARPUS*:
SECTION *STACHYCARPUS*

NETTA E. GRAY AND JOHN T. BUCHHOLZ

With four plates

THE SPECIES of *Podocarpus* concerned in this treatise all belong to section *Stachycarpus*. An earlier installment (5) was devoted to the five South American species and several varieties of this section. The South Pacific species discussed in this paper complete the group now included in this section. These fall into two subsections, A. *Euprumnopitys* and B. *Idioblastus*. Subsection *Euprumnopitys* includes the two New Zealand species (*P. spicatus* and *P. ferrugineus*) as well as all American species in the previous installment. The name, *Prumnopitys*, for this group was used in a category equivalent to a section by Bertrand (3), but, as such, must be considered a synonym under the earlier section, *Stachycarpus* Endlicher. The name had been proposed originally as a generic name in the binomial *Prumnopitys elegans* Philippi where it is clearly a synonym under *Podocarpus andinus* Poeppig. Nevertheless Philippi's binomial was continued until very recently in the horticultural trade. Dallimore and Jackson continued to use this binomial and only changed it to *Podocarpus andinus* in the 3rd edition (1948). In using this name, *Prumnopitys*, as a subsection under *Stachycarpus*, we are adding a prefix: *Euprumnopitys*. Subsection *Idioblastus* includes species in New Caledonia and the Queensland area of Australia, which differ in the presence of idioblastic sclereids (Plates III; IV, figs. 3-10) within the leaves, this being especially distinctive as it is the only group in *Podocarpus* with this type of sclereid. In the general description of this section (4) the section *Stachycarpus* is distinguished by small flat leaves (usually less than 3 cm. long by 0.5 cm. wide), with a single median vein and resin canal below, without hypoderm, without vascular fibers or sclereids and accessory transfusion tissue, the stomata showing the Florin ring present and the subsidiary cells usually amphicyclic (6). The exception to the usually hypostomatic leaves occurs in *P. ferruginoides*, *P. distichus* and its variety, in *P. Ladei*, and more rarely in juvenile foliage of *P. ferrugineus* where there are stomata in the upper epidermis especially over the midrib.

Transfusion tissue, usually of the type with reticulated-scalariform thickenings, is always present in the leaves of Podocarpaceae. It may be considered as a part of the vascular bundle with which it is intimately associated.

Accessory transfusion tissue, present in most Podocarpaceae, is entirely absent in subsection *Euprumnopitys* or, in subsection *Idioblastus*, it may

be represented by more or less isolated idioblastic sclereids that do not form a continuous tissue system. These elements should be related to the mesophyll of the leaf, as is the case for accessory transfusion tissue, the isolated sclereids of section *Afrocarpus*, and the auxiliary sclereids found in a number of species of subsection D of section *Eupodocarpus*. The idioblasts, very irregularly shaped sclereids with thick pitted walls, large lumina and without cell contents, may not be articulated with the transfusion tissue, at least not at the time when they begin to differentiate in the mesophyll. The abundance and pattern of these cells in the blade of the leaf deserve special consideration which will be given under the species involved.

Orr (18) was the first to describe these sclereids in the leaves of section *Stachycarpus* of *Podocarpus* where he observed them in *P. Ladei* and *P. ferruginoides*. His fig. 3, plate 2, shows these idioblasts in the latter species.

Early investigations utilizing idioblastic sclereids as taxonomic characters include a treatise by Pestalozzi (19) on *Boscia*. In recent work, Bailey and Nast (1, 2) and Foster (8, 10, 11) have considered sclereids as diagnostic characters in certain angiosperms, while Foster (8, 9, 12) has studied the ontogeny of sclereids in angiosperm leaves and Sterling (20) their origin in the shoot apex of *Pseudotsuga*. The various publications of Foster and his recent book (13) have given the historical background.

SUBDIVISIONS OF SECT. STACHYCARPUS

SUBSECTION A. *Euprumnopitys* (*Prumnopitys* Bertrand) Buchholz & Gray, nov. subsect.

Foliis sine sclereidibus in mesophyllo, hypostomaticis in foliis maturarum, sed in foliis juniorum plantarum *Podocarpi ferruginei* interdum extant quaedam in facie superiore stomata.

(Includes *P. spicatus* and *P. ferrugineus* as well as all American spp.)

SUBSECTION B. *Idioblastus* Buchholz & Gray, nov. subsect.

Foliis cum sclereidibus in mesophyllo, amphistomaticis, stomatibus in facie superiore multo-rarioribus quam in inferiore.

(Includes *P. ferruginoides*, *P. Ladei* and *P. distichus*.)

KEY TO THE SOUTH PACIFIC SPECIES OF *PODOCARPUS* BELONGING TO THE SECTION STACHYCARPUS

Idioblasts (or other sclereids) absent in the mesophyll of the leaves that are without hypoderm *.....Subsection A. *Euprumnopitys*.

Stomata always confined to the lower surface of the leaf; margin of the leaf symmetrically rounded and not tending to be revolute; male strobili spicate and numerous on special branches; female branchlets 4 cm. long; seed 8-9 mm. long, blackish.....*P. spicatus*.

* The two South Pacific species belonging here stand nearest to *P. andinus* of the American species. In our former key they belong with the category of leaf types essentially flat above. All American species of *Stachycarpus* are without sclereids.

Stomata very rarely found over midrib of the upper surface; leaf margins asymmetrically pointed and sometimes almost revolute; male strobili borne singly in axillary position or replacing foliage leaves; female branchlets 1 cm. long; seed 15–17 mm. long, red.....

.....*P. ferrugineus*.

Idioblasts present in the mesophyll of the leaves that are without hypoderm and are unequally amphistomatic.....Subsection B. *Idioblastus*.

Leaves with some stomata scattered over the entire upper surface; idioblasts small, mostly less than 250–300 μ long and well separated (plate IV, figs. 3 & 4); seed large, 2.5 cm. long.....*P. Ladei*.

Leaves with stomata of the upper surface relatively few, confined to the region of the midrib from the middle toward the apex.

Idioblasts mostly 300 μ or more (up to 550 μ) long and closely crowded together (plate IV, figs. 5 & 6); lower epidermal cells with simple walls, often slightly wavy but not dentate (plate IV, fig. 1); leaves 9–19 mm. long, 1.5–4 mm. wide...*P. ferruginoides*.

Idioblasts becoming more than 550 μ long; epidermal cells with distinctly wavy or dentate walls (plate IV, fig. 2).

Leaves with revolute margins, 10–15 mm. long, 2–3.5 mm. wide; idioblasts separated, becoming 600–750 μ long (plate IV, figs. 7 & 8); trees; seeds 12–15 mm. long, crested.....

.....*P. distichus*.

Leaves with narrowed or tapered, obtusely rounded margins, 2–3 cm. long, 5–6 mm. wide, nearly flat; idioblasts becoming 850–1100 μ long, closely crowded; known only as shrubs....

.....*P. distichus* var. *maialis*.

Podocarpus spicatus R. Br. in Bennett, Pl. Jav. Rar. 40. 1838; Hooker, Icon. 6: t. 543. 1843; Endlicher, Syn. Conif. 221. 1847; Hooker f., Fl. Nov. Zeland. 232. 1853; Handb. N. Z. Fl. 258. 1864; Carrière, Traité Conif. 675. 1867; Parlatores in DC. Prodr. 16(2): 519. 1868; Pilger in Pflanzenreich IV. 5(Heft 18): 65. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Mahlert in Bot. Centralbl. 24: 280, 281. 1885; Kirk, For. Flora N. Z. 5. 1889; Cheeseman, Man. N. Z. Fl. 650. 1906, ed. 2, 113. 1925; Allan in Trans. & Proc. N. Z. Inst. 56: 39–42. 1926; Cockayne, Veg. N. Z. 1921, 1928; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262, 263, 266. 1931; Dallimore & Jackson, Handb. Conif. 55. ed. 2, 1931, ed. 3, 81. 1948; Laing & Blackwell, Pl. N. Z. 66. 1940.

Dacrydium taxifolium Banks & Sol. ex Don in Lamb. Pin. ed. 1, 2: 25. 1824, ed. 2, 2: 119. 1828.

Dacrydium ?(Mai) A. Cunn. in Ann. Nat. Hist. 1: 213. 1838.

Dacrydium Mayi van Houtte ex Gordon, Pinetum 287. 1858.

Prumnopitys spicata Kent in Veitch, Man. Conif. ed. 2, 157. 1900.

Stachycarpus spicata Van Tieghem in Bull. Soc. Bot. France 38: 173. 1891.

This tree has long been known from New Zealand where it was one of the more important timber trees, having a thick trunk and becoming 25 m. tall. Useful descriptions and figures of the species are to be found in Kirk (16) and Laing & Blackwell (17). Vegetative buds small with

obtuse scales. Leaves linear, coriaceous, sessile, 1.0–1.5 cm. long and 1.0–1.5 mm. wide, midrib scarcely raised. In leaf cross section, this species can best be distinguished from *P. ferrugineus* by the very rounded margins. The very narrow leaves have the least number of rows of stomata, each band varying from 7 to 14 rows which are closely packed. In the upper epidermis we have not found any stomata. A study of the development of young leaves was made by Griffin (15) who found very slight lignification of the walls of mesophyll cells which showed a transverse orientation in the blade of the leaf.

When mature fruit of the tree is available the black color distinguishes it from *P. ferrugineus*. Peduncle about 4 cm. long. Also, the abundant (20–30) male strobili on a single peduncle are in contrast to the scattered, more solitary, axillary cones borne on leafy twigs of *P. ferrugineus*.

DISTRIBUTION: In New Zealand, on both North and South Island, but rarely on Stewart Island.

SPECIMENS EXAMINED:

NEW ZEALAND: NORTH ISLAND: Auckland Dist.: (voyage Astrolabe, ex Mus. Paris) *Hombroun* in 1841 (GH*); Oruanui, near Wairakei, *Setchell* in 1904 (UC); Kahikanui, *Setchell* in 1904 (UC); Wangarui, *Allison s.n.* (A); near Taumaruanui, *Cockayne 9097* (A), *Cockayne 6659* (UC); Wellington Dist.: Wairarapa, *Kirk s.n.* (†Mo). SOUTH ISLAND: Nelson Dist.: near Murchison, *Cockayne 8556* (A); Marlborough Dist.: Pelorus Sound, *Kirk s.n.* (A, †F, †GH); Canterbury Dist.: Banks Peninsula (Presqu'île de Banks) *Raoul* in 1843 (ex Mus. Paris) (GH); *J. Haast* in 1866 (†BR—2 sheets); *Kirk 295*, *Colenso* (GH); Invercargill?, *G. C. Smith s.n.* (A). LOCALITY UNKNOWN: Matai valley, *Cheeseman s.n.* (Ph); Limestone Creek Forest, Hunderlee, *Cockayne 6661b* (A); *Védel* in 1847 (voyage M. Bérard) (†BR, GH, Ph), *Védel s.n.* (NY); Anon. (ex J. M. Coulter) (†F); *Cunningham* in 1826 (†BR); *R. Brown 27, 60, 120, 3116* (TYPE on 2 sheets, British Museum). CULTIVATED: England: Roy. Bot. Gard. Kew, *Cook* in 1937 (†Ill); California: Golden Gate Park, *Eastwood* in 1916 (CAS); *Engelmann* in 1868, ex Hort. Neapol. (†Mo).

Podocarpus ferrugineus Don ex A. Cunn. in Ann. Nat. Hist. 1: 212. 1838; Hooker, Icon. 6: t. 542. 1843; Endlicher, Syn. Conif. 220. 1847; Hooker f., Fl. Nov. Zeland 1: 232. 1853; Carrière, Traité Conif. 674. 1867; Parlatore in DC. Prodr. 16(2): 519. 1868; Bertrand in Ann. Sci. Nat. ser. 5, 20: 61. 1874; Mahlert in Bot. Centralbl. 24: 280, 281. 1885; Kirk, Forest Fl. N. Z. 163. 1889;

* The following symbols indicate the herbaria having the specimens cited: Academy of Natural Sciences at Philadelphia (Ph), Arnold Arboretum (A), Brussels, Belgium (BR), University of California at Berkeley (UC), California Academy of Sciences (CAS), Chicago Natural History Museum (Field Museum) (F), University of Illinois (Ill), Gray Herbarium (GH), Missouri Botanical Garden (Mo), New York Botanical Garden (NY), United States National Herbarium (US).

† This symbol preceding the abbreviated name of an herbarium following the specimens examined signifies that the details of the leaves of this specimen have been examined in cross-section.

Kent in Veitch Man. Conif. ed. 2, 150. 1900; Pilger in Pflanzenreich IV. 5 (Heft 18): 66. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Cheeseman, Man. N. Z. Fl. 650. 1906, ed. 2, 113. 1925; Cockayne, Veg. N. Z. 1921, 1928; Dallimore & Jackson, Handb. Conif. ed. 2, 45. 1931, ed. 3, 68. 1948; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262. 1931; Laing & Blackwell, Pl. N. Z. 66, 1940.

Stachycarpus ferruginea Van Tieghem in Bull. Soc. Bot. France 38: 173. 1891.

Trees of this species are also very large important timber trees of New Zealand. Descriptions and figures of the tree may be found in Kirk (16) and Laing & Blackwell (17). The juvenile foliage is longer than the adult foliage and the leaves are a little wider than in *P. spicatus*. In cross section the leaf margins show a point or angle toward the lower surface, which can hardly be described as a tendency to be revolute, but nevertheless is in contrast to the rounded edge of the leaves of *P. spicatus*. The transfusion tissue consists of only about a half-dozen cells as seen in cross section.

Four specimens among those we examined (collected by Morhange, Capt. Home and two by Kirk) show a few stomata in the upper epidermis above the midvein. This would agree with Griffin (15) who found stomata in the upper epidermis of leaves of young specimens. She found that the mesophyll was somewhat transversely elongated but no evidence of lignification. The stomata are not in compact bands, appear more or less scattered and are rarely or only slightly separated by a midvein area without stomata.

DISTRIBUTION: New Zealand, according to Kirk (16) more plentiful on South Island than North Island and constituting a large part of the Stewart Island forests. It ranges from sea level to 3000 ft. altitude.

SPECIMENS EXAMINED:

NEW ZEALAND: **NORTH ISLAND:** Auckland Dist.: Whangarie Falls, *Setchell* in 1904 (†UC); Rautangata, *Setchell* in 1904 (UC); Kaipara Harbour, *Kirk* 242 (GH); *Kirk s.n.* (NY); Bay of Islands, U. S. Exploring Exped. under Capt. Wilkes 1838-42 (GH). Wellington Dist.: Mt. Ruapehu, *Meebold* 17905 (NY); Wellington, *Lawton s.n.* (†Ill). **SOUTH ISLAND:** Canterbury Dist.: *J. Haast* 233 (†BR); Longwood Forest, *Cockayne* 6658 (GH), *Cockayne* 6660 (†F, 2 sheets), *Cockayne* 9096 (A, 2 sheets); *Kirk s.n.* (†F); *Kirk s.n.* (†Mo). Stewart Island: *Kirk s.n.* (A). **LOCALITY UNKNOWN:** Murbel Beach, *Wilson* in 1921 (A, 3 sheets); *A. Cunn. s.n.* (A. R. Steward, 1850?) (NY); *Morhange s.n.* (†BR, 2 sheets); *J. D. Hooker* 46 (†BR); *Home s.n.* (Brit. Mus.). **CULTIVATED:** New Zealand: Auckland, *Wilson* in 1921 (A). California: Golden Gate Park, *Eastwood* in 1916 (CAS), *Walther* in 1922 (CAS), *Walther* in 1924 (A).

Podocarpus Ladei Bailey in Queensland Agricultural Jour. 15: 899. 1905; Bailey, Cat. Queensland Pl. 512, 1910; Pilger in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Florin in Svenska Vet.-Akad. Handl. ser.

3, 10(1): 262, 264, 266. 1931; Dallimore & Jackson, Handb. Conif. ed. 1, 48. 1923, ed. 2, 1931, ed. 3, 72. 1948.

A tall erect tree with a stem attaining a diameter of 1.7 m. with thin, smooth reddish brown bark which is shed in thin scales. Leaves sessile, spirally attached but spreading apart in one plane, green on both surfaces, oblong, 12–16 mm. long, 2.5–4 mm. wide, obtuse, the midvein usually evident, but not prominent, with stomata on both surfaces, but about twice as numerous below as above. Pollen cones unknown. Female branchlets with large sessile obovoid seeds near the ends, becoming about 25 mm. long, 15 mm. wide, pointed at both ends.

DISTRIBUTION: In Australia, Queensland, the region of Mt. Spurgeon and Atherton near Port Douglas.

SPECIMEN EXAMINED:

AUSTRALIA: QUEENSLAND: Atherton, *Morrotsy* in 1923 (†A).

This extremely rare species exists, to our knowledge, in the herbaria in only two collections — the one listed above and the type, collected by *Lade* in 1905 on Mt. Spurgeon, Mitchell River, Port Douglas. It is larger than any other tree in this group, the trunk attaining a diameter of about 1.7 meters. The leaves are distichous, usually obtuse, and almost sessile. In transverse section the leaves show similar anatomy to *P. ferruginoides*. The margins, however, tend to taper symmetrically toward the edge rather than either being bluntly rounded or pointed toward the lower side, and there is more extensive area of transfusion tissue. The stomata on the lower surface are quite abundant in the broad leaves, interrupted by the midvein into two bands of 20–26 loosely arranged rows. They are abundant enough in the upper epidermis to call the leaf truly amphistomatic. On the upper surface they are scattered and not interrupted by the midvein. The abundance of stomata, 33 rows across the top of the leaf, is about that on the lower surface of *P. ferrugineus*. They tend often to be monocyclic instead of amphicyclic as they are in the lower epidermis. Epidermal cells between stomata have peculiar vertical walls that might be described as combining a dentate with an undulating pattern. The sclereids are the smallest found in subsect. *Idioblastus*, usually less than 250–300 μ long, often less than half this length and are branched or multi-lobed, as shown in plate IV, figs. 3 & 4.

Podocarpus ferruginoides Compton in Jour. Linn. Soc. Bot. 14: 424. 1922; Pilger in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262, 264–266. 1931; Dallimore & Jackson, Handb. Conif. ed. 2, 45. 1931; ed. 3, 68. 1948.

A tree becoming 10–15 m. high with an erect trunk and a rough dark gray or blackish bark thin and scaling off in flakes. Branching irregular and ending in numerous twigs clothed with coriaceous dark green leaves, spirally attached, patent but spread apart distichously and persisting for several years. Leaves oblong-ob lanceolate, minutely cuspidate, 10–18 mm. long, 2.5–3 mm. wide, almost sessile but really on very short twisted

petioles 0.5 mm. long. Pollen cones unknown. Female reproductive branchlets axillary, 5–8 mm. long, thickly covered at base with minute triangular scales, the scales becoming larger and linear toward the distal end; scales 3–5 mm. long but scarcely 1 mm. wide, obtuse, more or less recurved, glaucous, resembling small leaves, of which the terminal bears one (seldom 2, only 1 developing) axillary ovule. Ovules ovoid, glaucous, obtusely apiculate. Seed ovoid, without crest, 12–14 mm. long, glaucous, the testa of two layers, the outer fleshy and the inner indurated. Plate I shows a photograph of a part of the type specimen.

DISTRIBUTION: In New Caledonia, on Mt. Humboldt, at the summit, and on Mt. Nekando, its eastern spur.

SPECIMENS EXAMINED:

NEW CALEDONIA: Mt. Nekando, *Compton 1068* (†Cambridge); *Compton 1073* (Brit. Museum); Mt. Humboldt, *Buchholz 1572, 1573* (Plate II, fig. 1; Plate III, fig. 1) (†Ill, with duplicates distributed elsewhere).

This is one of the less known species, having been first described in 1922 by Compton (6) from specimens he collected himself. When Orr (18) originally described the idioblasts to be found in this group, he used *Compton 1073*, the type specimen. His figure is of a leaf transverse section from this specimen.

In 1948 new collections added much to our knowledge of this species. On Mt. Humboldt it is a tree 8–9 m. high and 36 cm. in diameter at 1500 m. altitude on the west slope (*Buchholz 1573*), but at the summit, 1640 m., it is a low shrubby tree only 1–1.5 m. high (*Buchholz 1572*).

Small plants have leaves essentially similar to the adult form. Both the tree and shrub from Mt. Humboldt have idioblasts that agree very closely with those in the leaves of *Compton 1073* (examined from type specimen of British Museum) as well as *Compton 1068* (dried from alcoholic specimen of Compton's botanical collections at Cambridge). The specimens agree closely with a leaf from the type specimen as well as with the photomicrograph in Orr (18); hence there is no doubt concerning the identity of *Buchholz 1572* and *1573* from Mt. Humboldt. The sclereids are distinctly larger than in the preceding species. They are usually more than 300, up to 550 μ long, which is less than the larger sclereids in the species and variety that follow. Their branching is irregular, with relatively short branches or knobs and they are very closely crowded as shown in Plate IV, figs. 5 & 6.

In the lower epidermis of the leaf, the stomata are not arranged in two bands separated by the midrib, but are usually scattered across the surface and are more abundant than in *P. ferrugineus*. The stomata to be found in the upper epidermis vary from 1–11 rows, where they are always located over the midrib and not in the marginal parts of the blade. The simple walls of epidermal cells in the lower surface of the leaf are shown in Plate IV, fig. 1. Florin (7) has studied the epidermis of this species and interpreted the stomatal structure as amphicyclic.

***Podocarpus distichus* Buchholz sp. nov.**

Arbor demum 4–5 m. alta ramis 6 cm. vel ultra diametro, cortice atrogriseo subruvido. Ramis iterum ramulosis angulo acuto orientibus ob folia decurrentia longitudinaliter per internodia sulcatis. Alabastris terminalibus perulis longius attenuatis patentibus insignatis. Foliis spiraliter impositis sed distiche pectinatinque ob petiolum curvum patentibus, per annos 3–4 persistentibus. Foliis ex oblongo-lanceolatis ad oblongo-oblancheolatis, junioribus acutis minuteque cuspidatis, ad basem obliquis angustisque, petiolo curvato decurrente, 1–1.5 cm. longis, 2–3.5 mm. latis, 0.5 mm. crassis, costa interdum facie supera subelevata, subtus canaliculo brunneo notata. Foliis hypodermate destitutis, ducto resinifero ad phloematem unico, sclereidibus ramosis per mesophyllum more proprio dissitis ad 500–750 μ longis. Stomatibus saepius in facie foliis infera impositis, in supera paucioribus tantum ad costam. Cellulis epidermaticis inter stomata parietibus undulosis notabilibus.*

HABITAT: Mountains bordering the valley of the Kouaoua River on the eastern slopes of central New Caledonia and Table Unio, Mt. Mou.

SPECIMENS EXAMINED: Table Unio, Kouaoua, *Lecard* in 1878 (TYPE, Herb. Museum National d'Histoire Naturelle, Paris, fragment and photograph †III), *Buchholz 1600* (†III) (Plate II, fig. 2; Plate III, fig. 2), Mt. Mou, *Buchholz 1788* (†III); parts of both in Herb. Paris, and elsewhere.

This tree appears to be rare on Mt. Mou. It has escaped the notice of previous collectors and was found accidentally when a branch was broken from it by Mr. Luc Chevalier in collecting male specimens of *Acropyle Pancheri* in a dense tangle of other trees and shrubs.

This species has abundant sclereids in the mesophyll of the leaf. These are idioblasts of elongated form, each with slender cylindrical body and numerous slender dendritic branches. They occur in various assorted sizes up to 750 μ in length and are 50% larger than the sclereids in *P. ferruginoides*.

It seems likely that the idioblastic sclereids of this section of *Podocarpus* are distinctive in having diagnostic value as reliable as any single taxonomic character. The species before us could probably be identified by the idioblasts alone. When taken in combination with other characters, such as the epidermal cell walls as well as external taxonomic features there can be little doubt left concerning the identity of the species.

***Podocarpus distichus* var. *maialis* Buchholz nov. var.**

Frutex vel arbor, cortice obscuro subnigro asperato. Foliis saturate viridibus, elliptice oblongis, apice obtusis basis obliquis, subtus angustatis, petiolo torto minus quam 2 mm. longo, 2–3 cm. longis, 5–6 mm. latis, costa unica supra elevata, subtus subplanis vel canaliculatis, ramo spiraliter

* Data received since this paper went to press furnish the following addition to the description: Seeds single, 13–15 mm. long, crested and slightly flattened, with related bract ovate-lanceolate adherent to seed. Cone peduncles 7–9 mm. long, borne axillary and clothed with numerous small scales, the uppermost 3 or 4 of which become 2–3 mm. long and slightly spreading but not recurved.

impositis at habitu pectinatis, petiolo in ramum decurrente. Stomatibus in folii facie infera confertis, in facie supera seriebus 3–10 dissitis ad costam dispositis. Foliis intus idioblastis more proprio efformatis praeditis ad 850–1100 μ longis.

HABITAT: Forêt du Mois de Mai, bordering Plaine des Lacs, in southern New Caledonia at about 400 m.

SPECIMENS EXAMINED: *Buchholz 1391*, TYPE in †Herbarium University of Illinois (Plate II, fig. 3) and part in Herb. Mus. National d'Histoire Naturelle, Paris; *Bernier 360*, *Bernier 294* (Paris Museum, fragments only seen).

This may be a juvenile specimen, the seedling of an unrecognized larger tree. It is nevertheless possible to name and describe this entity as a definite variety if not a distinct species, belonging to subsection *Idioblastus* and most closely related to *P. distichus*. The distinctions from *P. distichus* are the much larger leaves, and fewer bud scales as indicated by the scale scars of annual growth shoots. In cross sections of the leaves the margins are more tapered than pointed toward the lower surface and the transfusion tissue is much more apparent than in *P. ferruginoides*. The idioblasts are much more abundant and considerably larger in this variety than in the species. From these criteria it should be possible to identify any later collections, adding descriptions of the reproductive parts where possible. The lower epidermis is shown in Plate IV, fig. 2.

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EXPLANATION OF PLATES

PLATE I

Podocarpus ferruginoides Compton. Photograph natural size of part of type specimen showing reproductive parts. Several fertile branches bearing ovules near time of pollination are shown at right and similar branches with seeds, presumably a year older, at left. Mt. Nekando, the type locality, is an eastern spur of Mt. Humboldt.

PLATE II

FIG. 1. *Podocarpus ferruginoides* Compton, Buchholz 1573 from tree near summit of Mt. Humboldt. $\times 1$. FIG. 2. *Podocarpus distichus*, part of Buchholz 1600 from a tree on mountain slopes of Kouaoua valley. $\times 1$. FIG. 3. *Podocarpus distichus* var. *maialis*, Buchholz 1391 from Forêt du Mois de Mai, Plaine des Lacs. $\times 1$.

PLATE III

FIG. 1. *Podocarpus ferruginoides* Compton, from Buchholz 1573, transverse section of leaf showing very thick cuticle with epidermal cells smaller than cuticular thickness above; absence of hypoderm; abundant sclereids within the leaf. Stomata shown below midvein as well as in blade, a few

stomata occurring also on the upper side in region above midvein. $\times 105$. FIG. 2. *Podocarpus distichus*, from *Buchholz 1600*, whole mount of entire leaf cleared with NaOH, the midvein and sclereids stained, mounted in balsam. The stomata may be seen as faint dots in the clear areas. $\times 16$.

PLATE IV

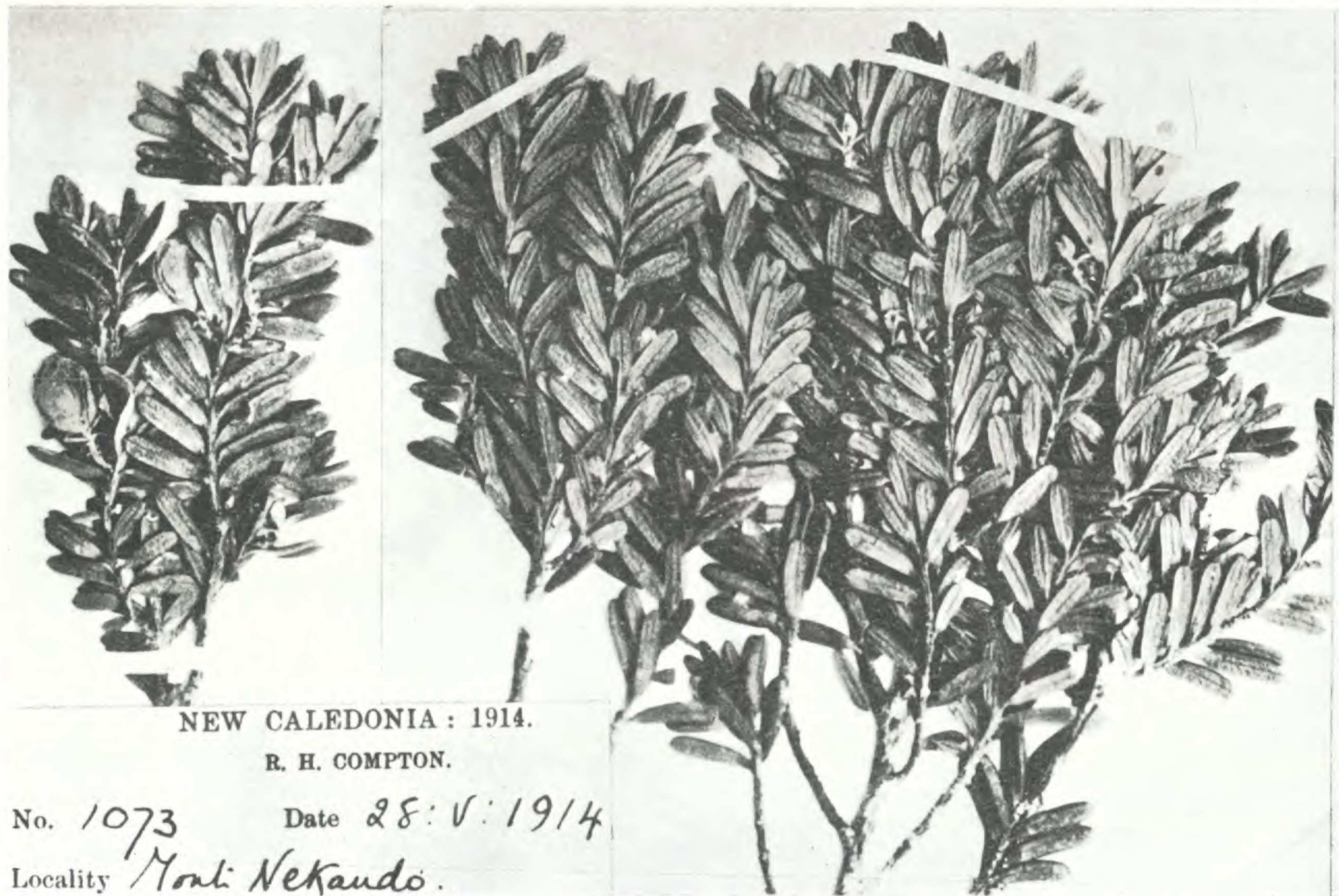
FIG. 1. *Podocarpus ferruginoides* Compton, *Buchholz 1573*, showing walls of epidermal cells between stomata not undulate—straight or occasionally denticulate. $\times 425$. FIG. 2. *Podocarpus distichus* var. *maialis*, from leaf of *Buchholz 1391* showing undulate walls in epidermal cells between stomata. (*P. distichus* has a similar lower epidermis.) $\times 425$. FIG. 3. *Podocarpus Ladei* Bailey, from leaf of *Morrotsy* in 1923, showing dispersed sclereids and midvein; stomata may be seen in cleared areas. $\times 21$. FIG. 4. Sclereids of same removed and isolated by dissection. $\times 61$. FIG. 5. *Podocarpus ferruginoides* Compton, from leaf of *Buchholz 1573* showing midvein with very abundant closely crowded sclereids. $\times 21$. FIG. 6. Sclereids removed by dissection from similar leaf of *Compton 1073*. $\times 61$. FIG. 7. *Podocarpus distichus*, part of the cleared leaf shown in Plate III, figure 2, showing midvein and dispersed sclereids; stomata may be seen in clear areas. $\times 21$. FIG. 8. Sclereids of same removed and isolated by dissection. $\times 61$. FIG. 9. *Podocarpus distichus* var. *maialis*, from leaf of *Buchholz 1391* showing midvein and closely crowded sclereids; stomata may be seen in clear areas. $\times 21$. FIG. 10. Sclereids of same removed and isolated by dissection. $\times 61$.

EMORY UNIVERSITY, GEORGIA,

AND

UNIVERSITY OF ILLINOIS,

URBANA, ILLINOIS.



HERB. MUSEI BRITANNICI

NEW CALEDONIA : 1914.

R. H. COMPTON.

No. 1073

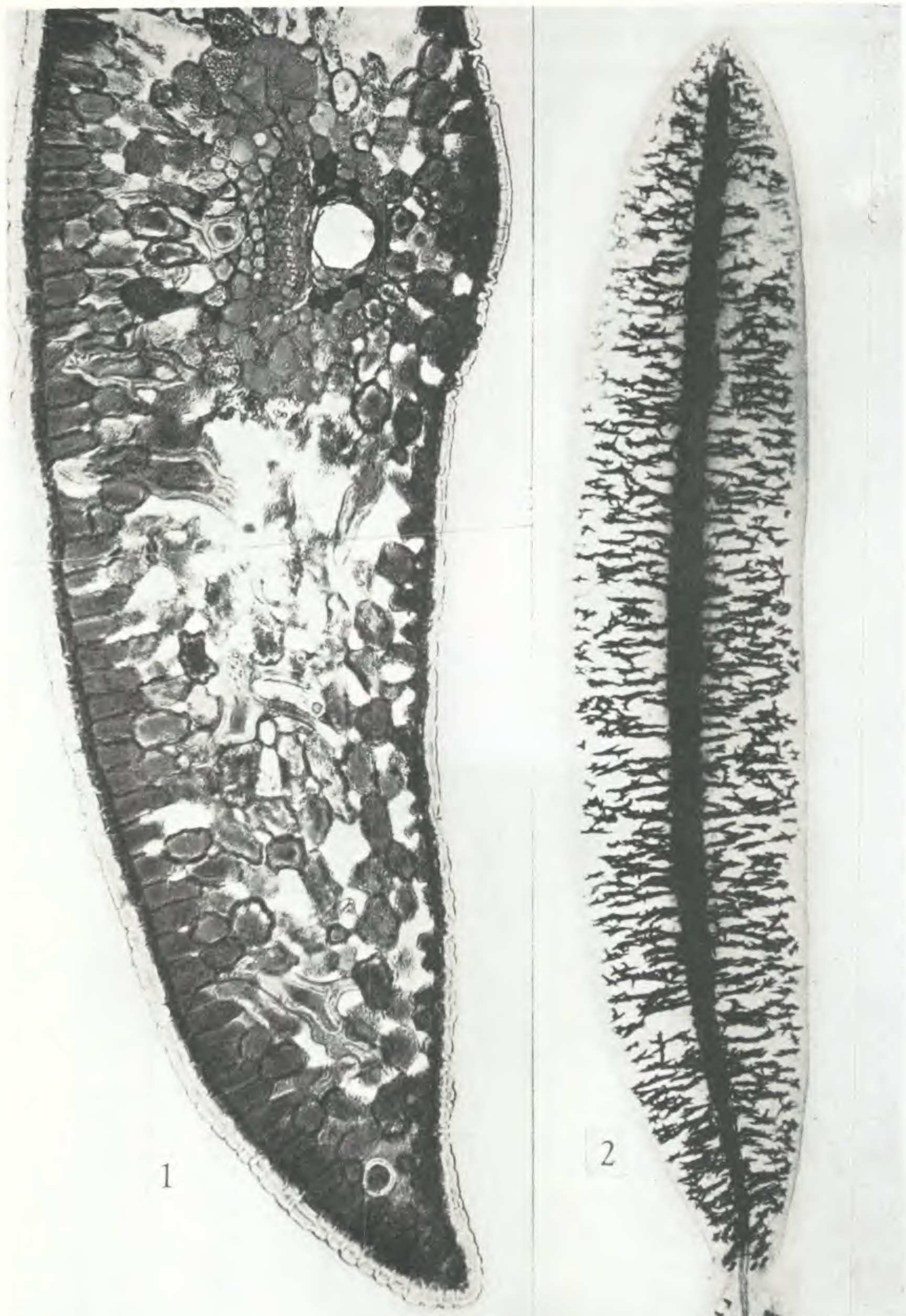
Date 28: V: 1914

Locality *Monti Nekaudi.*

GRAY & BUCHHOLZ, *PODOCARPUS*



GRAY & BUCHHOLZ, *PODOCARPUS*



GRAY & BUCHHOLZ, *PODOCARPUS*



GRAY & BUCHHOLZ, *PODOCARPUS*

A TAXONOMIC REVISION OF *PODOCARPUS*
VI. THE SOUTH PACIFIC SPECIES OF *PODOCARPUS*:
SECTION *SUNDACARPUS*

NETTA E. GRAY AND JOHN T. BUCHHOLZ

THE SECTION *Sundacarpus* of *Podocarpus* is represented by the single species *Podocarpus amarus* Blume. Recently the distribution and characters of this species were outlined by Wasscher (5) with which he includes a small map (his fig. 1) showing the region in which it is found. However, Wasscher treated this species as the sole Indo-Malaysian representative of the subgenus *Stachycarpus* Endl. in the sense of Pilger (1926), while this use of the section *Sundacarpus* was set forth in a work which modified the sections of *Podocarpus*, separating those not so closely related (1).

Among the world's species of *Podocarpus* which have been extensively collected, *P. amarus* Blume, the only representative of this section, is the most singular. It is a species that may be identified by the leaf anatomy alone, in fact, only a small fragment of the leaf across the midvein would be necessary to establish the identity. Even externally this species may be recognized by the leaf, for it is the only western Pacific species of *Podocarpus* having a groove above the midvein.

To the student of phylogeny the anatomy of the leaf of this species offers much that is of special interest. It combines in a single species histological features that are common to four sections of the genus. The absence of hypoderm is a condition in common with sect. *Stachycarpus*, but the leaf is very large in comparison with any species in this section as we have defined it. The well developed accessory transfusion tissue is a character in common with the large section *Eupodocarpus*. On the other hand, the reproductive structures of *P. amarus* appear to be most closely related to sections *Nageia* and *Afrocarpus*. When all the botanical characters are considered, one is impressed by the fact that section *Sundacarpus* affords a bridge that connects several sections of this large genus.

Podocarpus amarus Blume, Enum. Pl. Javae 88. 1827, in Rumphia 3: 213. 1847; Endlicher, Syn. Conif. 217. 1847; Miquel, Fl. Ind. Bat. 2: 1073. 1856; DeBoer, Conif. Archip. Ind. 20. 1866; Carrière, Traité Conif. 667. 1867; Parlato in DC. Prodr. 16(2): 516. 1868; Bertrand in Ann. Sci. Nat. ser. 5, 20: 67. 1874; Van Tieghem in Bull. Soc. Bot. France 38: 169. 1891; Warburg in Monsunia 1: 192. 1900; Pilger in Pflanzenreich IV. 5(Heft 18): 68. 1903, in Nat. Pflanzenfam. ed. 2, 13: 245. 1926; Dallimore & Jackson, Handb. Conif. ed. 2, 39. 1931; Florin in Svenska Vet.-Akad. Handl. ser. 3, 10(1): 262. 1931; Merrill in Contrib. Arnold Arb. 8: 14. 1934; Wasscher in Blumea 4: 381. 1941; Orr in Trans. Bot. Soc. Edinburgh 34: 11. 1944.